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Using Honey Bees to Pollinate Crops



USING HONEY BEES TO POLLINATE CROPS

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The honey bee is man's most useful insect. In the United States alone, about 4 million colonies annually produce about \$100 million worth of honey and beeswax. While performing this profitable service, honey bees also pollinate more than \$1 billion worth of valuable agricultural crops.

Maximum yields of many fruit, vegetable, and seed crops often require more insect pollinators than are naturally present in an area at flowering time. For this reason, crop producers rent about 1 million colonies of honey bees each year to pollinate crops.

CHARACTERISTICS OF BEES

Although many kinds of insects visit flowers in search of nectar, few are important as pollinators of crops. Usually they have too specialized food habits, or are too few in number. In fact, if it were not for honey bees, yields from many of our crops would be uneconomical.

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Honey bees account for about 80 percent of insect pollination service to crops.

The honey bee is an unusually industrious insect. It visits a wider variety of flower types than any other insect. In a single day, one bee

Pesticide Danger To Bees

Pesticides are the single most serious problem to beekeeping in agricultural areas. Many crops must be protected from insect pests and diseases, but they must also be pollinated by bees.

For further information on protecting bees from pesticides, see Leaflet No. 563, "Pesticides and Honey Bees." Single copies of this publication—prepared by the Agricultural Research Service—can be obtained free from your County Extension Agent or by writing to the Office of Communication, U.S. Department of Agriculture, Washington, D.C. 20250. Send your request on a postcard. Be sure to include your ZIP Code and your return address.

may make a dozen or more trips from the hive, and it may visit several thousand flowers. But on each trip it usually confines its visits to one plant species, collecting one kind of nectar and distributing one kind of pollen. This characteristic, coupled with its hairy body, enables the honey bee to accumulate and distribute an abundance of pollen, and makes it our most valuable agent for cross-pollinating crops.

Beekeepers maintain honey bee colonies in most agricultural areas. They are usually equipped to move colonies easily and quickly to any location to concentrate bee pollination activity in areas where most needed.

CROPS POLLINATED BY BEES

Some of the crops that require, or at least benefit from, bee pollination are listed below. The alphabetical lists are grouped into forage and legume crops, fruit crops, nut crops, vegetable crops, and miscellaneous crops. Not included are range plants, ornamentals, medicinals, spices, and forest trees—many of which are also pollinated by bees. Crops marked with an asterisk often are stocked with hives to provide supplementary pollination by honey bees and thereby increase yields.

Forage and legume crops

*Alfalfa; buckwheat; clover (alsike, berseem, crimson, Egyptian, ladino, *red, rose, strawberry, and white); *crown vetch; sweet clover (*hubam, sour, *white, *yellow);

lespedeza (bush); *trefoil; vetch (*hairy, and purple.)

Fruit crops

*Apple; apricot; avocado; berry (blackberry, *blueberry, boysenberry, *cranberry, gooseberry, raspberry, and strawberry); cherry; citrus (grapefruit, *mandarin orange, *tangelo orange, and *tangerine); grape (some varieties); mango; musk melon (*cantaloup, casaba, citron, *honeydew, and Persian); nectarine; *peach; *pear; persimmon; *plum, and *prune.

Nut crops

*Almond; chestnut; coconut; and macadamia.

Oilseed crops

*Cotton; flax; *rape; *safflower; soybeans; *sunflower; and Tung.

Vegetable crops

Asparagus; broccoli; Brussels sprout; *carrot; cauliflower; celery; Chinese cabbage; collard; *cucumber; eggplant; kale; kohlrabi; leek; *lima bean; mustard; *onion; parsley; pepper; pumpkin; *radish; rutabaga; squash; *turnip; and watermelon.

RENTING HONEY BEE COLONIES

Honey bee colonies can be rented in some areas either from a custom pollination service or from a local beekeeper. In both cases, obtain a written contract or agreement that covers the following—

- Number and strength of colonies to be used.

- Plan of distribution of colonies in the field.
- Time of delivery and removal.
- The beekeeper's right of entry to service his colonies.
- The degree of protection from pesticides that will be given the bees.
- Plan of payment of the rental fees.

USING STRONG COLONIES

Since there is no set number of honey bees in a colony, one needs to know about differences in colony strength before renting bees for pollination. Colony strength refers to the number of bees in the hive or the area of a hive that is densely occupied by bees. A strong colony has about 15,000 bees in each deep section (super, story, or hive body). When such a hive is opened, bees will immediately appear to "boil over" and cover the tops of the frames.

Whenever recommendations are made in this bulletin for a given number of colonies per acre, it is assumed that the colonies used are strong colonies in hives of two stories or more. And while most beekeepers can be relied on to supply strong colonies, check to be sure that colonies you rent are strong. Weak colonies at bargain prices are a poor investment. Such colonies may not pollinate your crop effectively, and yields may suffer.

A colony that is used to pollinate crops should be housed in at least a two-story hive, containing at least 30,000 bees, and have 6 to 12 full frames of brood in all stages of development. If possible, obtain



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A reasonably strong two-story colony of honey bees.

stronger colonies; however, when colonies are too strong, the working force will swarm away. Get the beekeeper's advice as to how strong the colonies should be before they will swarm.

ESTIMATING COLONY STRENGTH

To estimate colony strength, look inside the hive. The strength of a colony cannot be determined by the size of the hive it occupies. Use a veil and gloves when opening the hives.

When the weather is good, two or three dozen bees should be flying

around the entrances of strong colonies. Fewer flying bees at some colonies may indicate the colonies are not strong.

The beekeeper can smoke the entrance of a hive to calm the bees and then raise the cover. Dozens of bees should be seen on every frame.

Next, the beekeeper should be asked to pry the supers, or stories, apart. More bees should be seen on every frame in both supers. Check all the supers if the hive is more than two stories high. A colony with a cluster of bees on only a few frames near the center of the hive is generally too weak to be of much value for crop pollination.

Many people estimate colony strength in square inches of brood. Have the beekeeper lift out the brood frames. Count the brood frames and multiply each by 100 to get a rough estimate of the square inches.

A strong colony should have from 6 to 12 frames, or 600 to 1,200 square inches, of brood. A blanket of bees should cover all the brood.

Learn to distinguish between brood, honey, pollen, and empty combs. Honey in the comb takes up bee clustering space; therefore, a hive with a large amount of honey in it will appear stronger than one with little honey.

NUMBER OF COLONIES TO USE

Because of the wide variety of conditions that can exist in any area, the precise number of bees that you will need cannot be given. However, the number of honey bees necessary

primarily depends on the number of natural pollinators already in the area, and on the number of other crops that may be competing for the attention of pollinating insects.

The following list shows the minimum numbers of strong honey bee colonies per acre that you need to pollinate crops under most conditions.

<i>Colonies per acre</i>	<i>Crops</i>
1 to 2---	Cherries, musk melons (cantaloup, watermelon, etc.) ; peaches, plums, tangelos, tangerines, squash, almonds, apples, clovers (alsike, crimson, ladino, white) ; pears, trefoils, vetch (purple, hairy) ; cucumber, and cotton.
3 to 4---	Alfalfa, almonds, carrots, sunflowers, sweetclovers, blueberries, cranberries, onions, and red clover.

COLONY DISTRIBUTION IN THE FIELD

Honey bees usually pollinate flowers more thoroughly within 100 yards of their colonies than they do flowers at greater distances. To get the best coverage, therefore, you must distribute the honey bee colonies in groups throughout the fields or orchards you want pollinated.

In fields of less than 40 acres, the colonies may be placed along the borders of the field. In fields of more than 40 acres, put the colonies in the field in groups 0.1 mile (528 feet) apart in all directions. The following list gives the number of colonies you should use in each group when you need a certain number of colonies per acre. For example, if you need one colony per acre for the

crop being pollinated, you should have seven colonies in each group. If 2 colonies per acre are needed, put 13 colonies in each group or location, and so on down the list.

<i>Colonies per acre:</i>	<i>Colonies per group</i>
1 -----	7
2 -----	13
3 -----	20
4 -----	26

SCHEDULING DELIVERY OF COLONIES

Schedule the delivery of honey bee colonies to coincide with the flowering cycle of the crop you want pollinated. Flowering cycles vary. As a general rule, you should have colonies already located in the field when blooms first appear. However, you can move bees into alfalfa fields a few at a time, since all of them may not be needed until the crop reaches full bloom (about 10 days after alfalfa starts blooming).

Whenever bees are moved to a new location, they go through a period of orientation during which they get used to their new surroundings. Throughout this time, they are most effective as pollinators of the flowers nearest the hive. Once fully oriented, their foraging extends farther.

POLLENIZERS

Many varieties of fruit trees and some other plants produce no fruit when pollinated with their own pollen. They must be cross-pollinated. Trees that must be cross-pollinated

require pollen from other closely related fruit varieties. Some of them accept pollen only from particular varieties.

Those that must be cross-pollinated include all varieties of almonds, chestnuts, and sweet cherries; certain citrus; most varieties of apples, pears, plums, prunes, and blueberries; and a few varieties of peaches and apricots.

The varieties that produce suitable pollen for cross-pollination are called pollenizers. Pollenizers must be planted where bees will visit their flowers, as well as the flowers of varieties that must be pollinated, on a single flight. Pollenizers usually are interspaced between trees of the main variety.

Another effective method of pollinating is to graft branches of pollenizers to trees of the variety that must be pollinated. Grafts should be located where bees are most likely to visit—sheltered from prevailing winds, but exposed to the sun.

Hand-collected pollen can be placed in a pollen dispenser in the entrance of a beehive. Bees leaving the hive come into contact with the pollen and carry it to the flowers they visit.

To keep commercial pollen potent, follow all directions for its proper care. Hand-collected pollen is expensive and is generally used only as a last resort to get the plants pollinated.

Bees also are used to pollinate male-sterile plants that have been developed for mass producing hybrid seed of several bee-pollinated crops. Bees carry pollen from se-

lected male-fertile plants, to cross-pollinate the flowers of the male sterile plants.

Some bee-pollinated hybrid crops are cucumber, onion, and squash. To produce these crops, every third to fifth row is planted to the male parent; the remaining rows are

planted to the female parent. Similar methods are being developed for producing hybrid seed of alfalfa, cotton, melon, safflower, and some other field crops. In general, the bees are used on these crops the same way they are used on the other crops mentioned in this leaflet.

For More Information

Single copies of the following publications on bees and beekeeping—prepared by the Agricultural Research Service—can be obtained free from your County Extension Agent or by writing to the Office of Communication, U.S. Department of Agriculture, Washington, D.C. 20250. Send your request on a postcard. Be sure to include your ZIP Code and your return address.

AIB 313—Identifying Bee Diseases in the Apiary

AH 353—Beekeeping in the United States

AH 496—Insect Pollination of Cultivated Crop Plants

FB 2204—Selecting and Operating Beekeeping Equipment

Leaflet 530—Shade and Water for the Honey Bee Colony

HG 158—Beekeeping for Beginners

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Revised May 1977

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